Madeira Pilot – data transformation

In Madeira the SMILE project is focused in developing technologies to make the electrical grid smarter, especially

o Increasing the amount of self-consumption in photo voltaic (PV) owners

o Stabilizing the grid in areas with a high amount of PV injection into the grid

o Implementing smart charging techniques for electric vehicles.

These overalls goal led to the development and deployment of several hardware/software components:

o   Energy monitors

o   PV systems

o   Smart chargers

o   Battery Storage Systems

All the equipment communicates with a centralized entity known as the **Energy Management System (EMS)**.

o   Responsible for aggregating all the data and providing APIs for the basic CRUD operations
   •   To be used by the project partners during the pilots operation

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The EMS is stores the data in a series of noSQL and SQL databases

In general all **the data that reaches the EMS is formatted in the JSON format.**

However the actual pilots equipment uses different protocols/data formats

- o Modbus-RTU
- o JSON
- o uart
- o HTTP
- o IEC61851
- o Serial/Rfid
- o ...

The data transformation is accomplished by a piece of custom hardware installed every pilot location

The gateway

Regarding the data pipeline in SMiLE the gateway is responsible for

- o   Reading data from the different equipment
- o   Formatting to the JSON format
- o   Pushing it to the EMS
- o   Storing local backups
- o   Pushing raw data for another persistent storage server
  - o   Backup server

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The development of the **gateway** increased the overall cost of each installation

However it is a crucial component to assure the proper integration of all the equipment.

- Especially considering that the project attempts to evaluate in the real world how different smartgrid approaches can impact the grid quality, as well as its consumers
- With this approach we guaranteed that all the hardware/software upstream of the actual smartgrid hardware *"talks the same language"* which is important when there is the need to test new equipment.
- Or to interface equipment that which were not supposed to (e.g. equipment from different manufacturers)

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In detail – **Integration with of consumption from an energy meter**

The gateway communicates with an Carlo Gavazzi Energy Meter, using the ModBus-RTU protocol.

A series of python scripts are responsible for:
- o   acquiring the data from the energy monitor
- o   averaging for the required frequency
- o   pushing data for the backend
- o   verifying the data was sent correctly
- o   averaging the data for a csv file
- o   uploading for a google drive backup account

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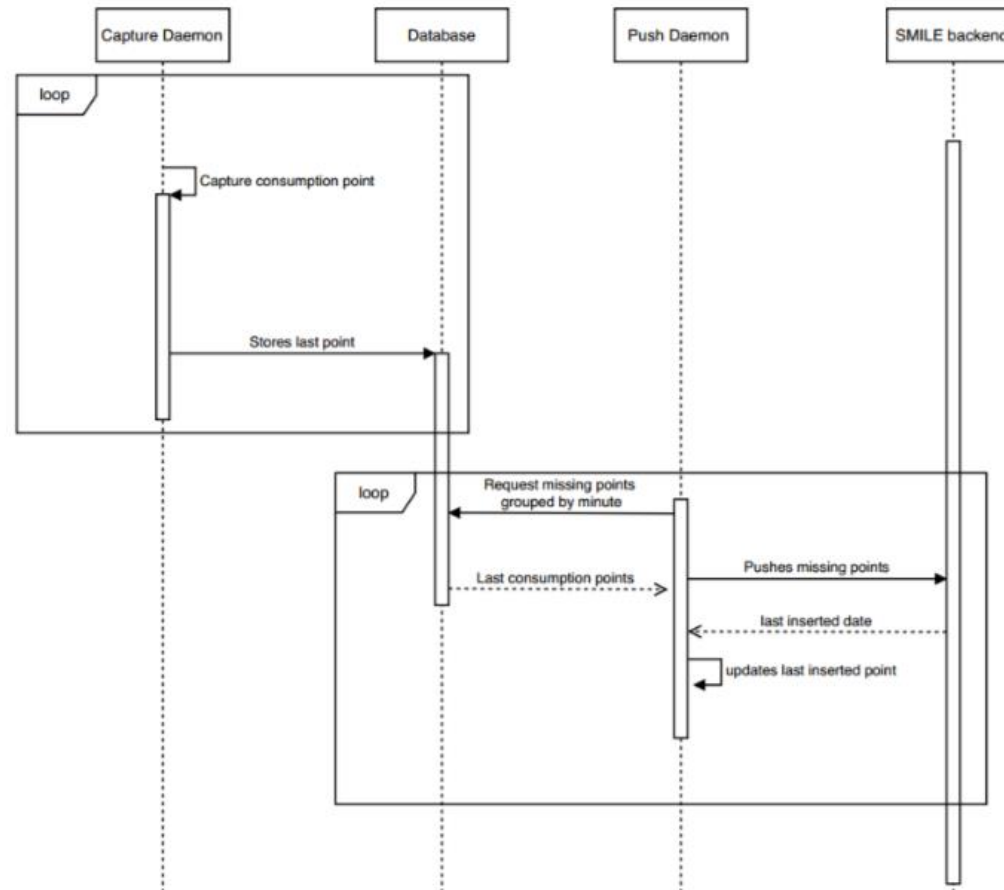
In detail – Integration with of consumption from an energy meter

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In detail – Integration with of consumption from an energy meter

The EMS aggregates the consumption data together with data from other pilot sites.

It used a document based database
- The sources of the data can be customized per pilot
- The schemas used to define the data format can be customized
- For the **gateway->energy meter** case-study the schema is

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{
    "_id" : ObjectId("5a69c4f39e0312c306bc423c"),
    "type" : "jsonListener",
    "config" : {
        "slug" : "carlo-usage",
        "producerRequired" : true,
        "converter" : {
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                "PF" : {
                    "type" : "identity"
                },
                "I" : {
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                "V" : {
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                },
                "S" : {
                    "type" : "identity"
                },
                "Q" : {
                    "type" : "identity"
                },
                "P" : {
                    "type" : "identity"
                }
            }
        },

            "L2" : {
                "PF" : {
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                },
                "I" : {
                    "type" : "identity"
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                "V" : {
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                },
                "S" : {
                    "type" : "identity"
                },
                "Q" : {
                    "type" : "identity"
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                "P" : {
                    "type" : "identity"
                }
            },
            "L1" : {
                "PF" : {
                    "type" : "identity"
                },
                "I" : {
                    "type" : "identity"
                },
                "V" : {
                    "type" : "identity"
                },

            "S" : {
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            "Q" : {
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            "P" : {
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            }
        },
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        },
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            "type" : "datetime",
            "typeParams" : {
                "format" : "YYYY-MM-DDTHH:mm:ssZ"
            }
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        },
        "measure_prod" : {
            "type" : "identity"
        },
        "measure_grid" : {
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        }
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    "name" : "carlo-usage"
    },
    "__v" : 0
}
```
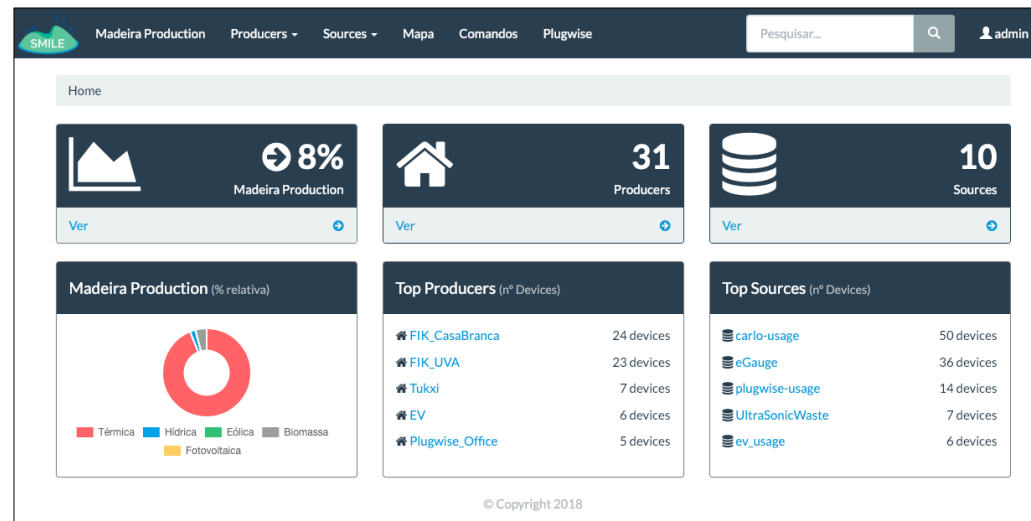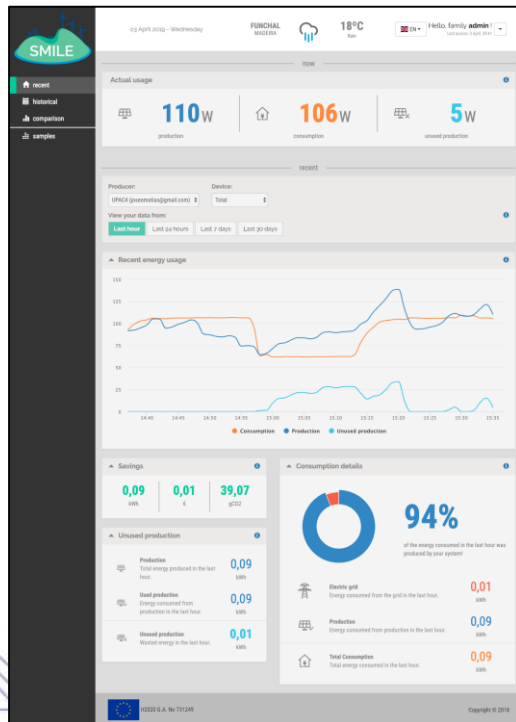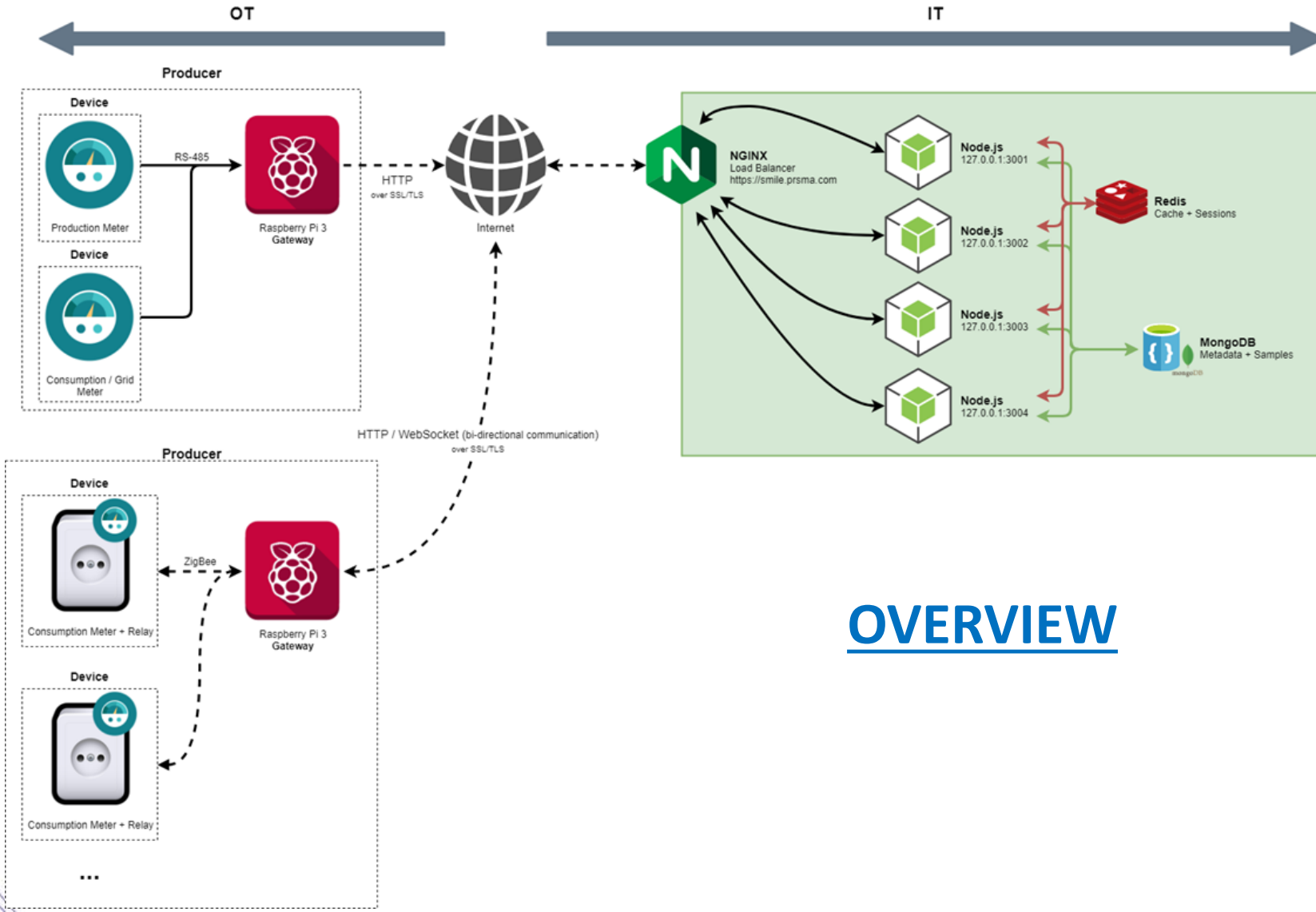
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In detail – Integration with of consumption from an energy meter

Once in the EMS the data is available in an admin and visualization tool

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OVERVIEW

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Questions?

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